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SUBJECT: Twentieth AAP Flight Operations Plan Meeting, MSC, August 23, 1968 - Case 610

DATE: September 16, 1968

FROM: B. H. Crane

MEMORANDUM FOR FILE

The Twentieth AAP Flight Operations Plan (FOP) Meeting included reports on a minimum-altitude constraint for the cluster orbit, electrical power available from the CM batteries for reentry, and limitations in data-recording capability for a high-inclination ATM mission. W. Hamby also presented AAPO's recommendations for unmanned LM/ATM rendezvous for information. Brief summaries of these topics follow:

1. Cluster Orbit

205 nm appears to be the minimum perigee for the cluster orbit that is consistent with the maximum WACS propellant capacity. MPAD reported that an elliptical orbit with a perigee below 205 nm would require more than the available propellant to overcome aerodynamic and gravity-gradient torques. This fact precludes inserting the cluster into an elliptical orbit such as 170 x 300 nm, as had been suggested to increase the AAP-2 payload. In this connection, the Flight Control Division (FCD) stated that, if the cluster were inserted into an elliptical orbit, delaying S-IVB propellant dumping until the first apogee appears to be acceptable.

2. Electrical Power for Reentry

North American-Rockwell reported that the CM batteries provide sufficient power for reentry and more than 72 hours after landing, if all four batteries are used. 48 hours are available for recovery using only three batteries. They estimate that the four CM batteries can supply 158 amp-hrs for reentry and recovery. About 29 amp-hrs are needed during the reentry phase, leaving 129 amp-hrs available for recovery. 117 amp-hrs would be used in 72 hours on the ocean, assuming full use of the 60%, built-in duty cycle for the recovery beacon and a duty cycle for the ECS fan as follows: high for the first hour, low for five minutes out of every succeeding half hour, off during the remaining time. Landing in colder water at a high latitude would not reduce the power required for the fan, because of requirements for CO_2 removal. Additional details from this report will be included in the FOP minutes.

3. Data Recording for a High Inclination ATM Mission

FCD concurs with MSFC that the two Auxiliary Storage and Playback Recorders on the ATM do not provide adequate data storage for a high inclination ATM mission. They stated that mission planning should be based on one primary recorder, with the second recorder used only as a back-up in case of a failure. Data that MSFC had submitted for the minutes of the Nineteenth FOP meeting indicated that in 500 orbits, intervals exceeding ninety minutes without playback include: four averaging 141 minutes over, 67 averaging 45 minutes over, and 68 gaps just over ninety minutes. This data was obtained from an approximate trajectory and was based only on geometrical considerations, using a 5° elevation as the cut-off for each station pass. Similar figures for a 2° elevation were also included.

4. Status of Unmanned Rendezvous

The AAPO study on unmanned LM/ATM rendezvous recommends a coelliptic, M = 4 rendezvous for mission planning purposes in preference to a hybrid stable orbit technique. In the recommended configuration, the catch-up phase is nominally controlled by the ground and the terminal phase is controlled automatically by the LM-A, maintaining an attitude along the line of sight to the cluster for radar tracking. Automatic control is used as a back-up for the catch-up phase while the ground provides back-up for TPI. Capability will be provided for the crew to manually controll the terminal-phase midcourse and braking maneuvers from the cluster. Advantages cited for the coelliptic technique are that it is more compatible with crew participation in the rendezvous and is less sensitive to dispersions.

5. Schedule of FOP Meetings

The next several AAP FOP meetings will occur at two to three month intervals, since CM/SM delivery is expected to further delay the schedule for AAP launches. Reports that are expected to be ready by the next meeting, scheduled for October 18, include (1) alternatives available on AAP 1-2 for night launch, night landing, or South Atlantic recovery zones, (2) system operating constraints for the CM/SM and ATM, (3) ATM antenna patterns for simultaneous real time and recorded telemetry, and (4) crew lighting requirements for an unmanned LM/ATM rendezvous.

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